UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/994,395	11/26/2001	Sergey D. Lopatin	039153-0457 (G1162)	7882

7590 06/26/2006

Paul S. Hunter
FOLEY & LARDNER
Firstar Center
777 East Wisconsin Avenue
Milwaukee, WI 53202-5367

EXAMINER	
NADAV, ORI	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 06/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/994,395	LOPATIN ET AL.	
	Examiner	Art Unit	
	Ori Nadav	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 April 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6,8-13,15-20,22 and 23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6,8-13,15-20,22 and 23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 6, 8, 10, 13 and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soininen et al. (6,482,740) in view of Edelstein et al. (6,399,496) and Bogel et al. (6,749,699).

Soininen et al. teach in figure 1 and related text a method of fabricating an integrated circuit, the method comprising:

Depositing an etch stop laver 6 over a first conductive laver 2, wherein the etch stop laver is in direct contact with the first conductive laver;

depositing an insulating laver 8 after the etch stop laver is deposited over the etch stop laver;

forming a barrier layer 14 extending along lateral side walls and a bottom of a via aperture, the via aperture being configured to receive a via material that electrically connects the first conductive layer 2 and a second conductive layer 18; and

depositing/filling a copper 18 alloy (see figure 4 and related text) via material in the via aperture to form a via.

Soininen et al. do not teach the copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr).

Edelstein et al. teach a copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr) (column 8, lines 35-52).

Bogel et al. teach that Calcium (Ca) or Chromium (Cr) increases the grain size having one atomic percent or less (column 7, lines 65-67).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr) in Soininen et al.'s device in order to provide a stable Cu alloy with improved electromigration properties.

Claims 4 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soininen et al., Edelstein et al. and Bogel et al., as applied to claim 1 above, and further in view of Merchant et al. (6,440,849).

Regarding claim 4, Soininen et al., Edelstein et al. and Bogel et al. teach substantially the entire claimed structure, as applied to claim 1 above, except the copper alloy via material includes one atomic percent or less of Zinc (Zn) or Silver (Ag).

Merchant et al. teach the copper alloy via material includes one atomic percent or less of Zinc (Zn) or Silver (Ag) (column 3, lines 6-12).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the copper alloy via material includes one atomic percent or less of Zinc (Zn) or Silver (Ag) in prior art's device in order to provide a stable Cu alloy with improved electromigration properties.

Regarding claim 22, Merchant et al. teach stuffed grain boundaries.

Claims 9 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soininen et al., Edelstein et al. and Bogel et al., as applied to claims 1 and 6 above, and further in view of Gross (6,380,083).

Soininen et al., Edelstein et al. and Bogel et al. teach substantially the entire claimed structure, as applied to claims 1 and 6 above, except the increased grain size is between 0.5 and 3 microns.

Gross teaches an increased grain size is between 0.5 and 3 microns (column 5, lines 30-36).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an increased grain size is between 0.5 and 3 microns in prior art's device in order to provide a stable Cu alloy with improved electromigration properties.

Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soininen et al., Edelstein et al. and Bogel et al., as applied to claim 10 above, and further in view of Andricacos et al. (6,090,710).

Soininen et al., Edelstein et al. and Bogel et al. teach substantially the entire claimed structure, as applied to claim 10 above, except the ternary copper alloy via material is at least 98 atomic percent copper and includes Zinc (Zn), Silver (Ag), or Tin (Sn).

Andricacos et al. teach a ternary copper alloy via material is at least 98 atomic percent copper and includes Zinc (Zn), Silver (Ag), or Tin (Sn) (column 8, lines 15-16 and table 1).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a ternary copper alloy via material is at least 98 atomic percent copper and includes Zinc (Zn), Silver (Ag), or Tin (Sn) in prior art's device in order to obtain low resistance copper alloy for vias.

Response to Arguments

Applicant argues that the examiner's statement that combining the teachings of the references would provide a stable Cu alloy with improved electromigration properties is merely stating an alleged result of the combination and not a motive for the combination.

If the result of combining the references produces a superior device, then this is motivation to an artisan to combine the references.

Applicant argues that Edelstein et al. do not teach increasing the grain size, and that Bogel et al. do not teach an increase in grain size due to chromium.

Although Edelstein et al. and Bogel et al. do not explicitly state increasing the grain size due to chromium, these features are inherent in prior art's device, because the addition of Calcium (Ca) or Chromium (Cr) increases the grain size.

Conclusion

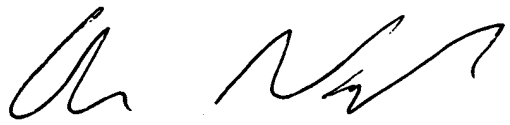
THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



O.N.
6/20/06

ORI NADAV
PRIMARY EXAMINER
TECHNOLOGY CENTER 2800